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HAIR CONDITIONING COMPOSITION COMPRISING CATIONIC SILICONE EMULSION

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TECHNICAL FIELD

The present invention relates to hair conditioning composition comprising a cationic silicone emulsion.

BACKGROUND

Human hair becomes soiled due to its contact with the surrounding environment and from the sebum secreted by the scalp. The soiling of hair causes it to have a dirty feel and an unattractive appearance. The soiling of the hair necessitates shampooing with frequent regularity.

Shampooing cleans the hair by removing excess soil and sebum. However, shampooing can leave the hair in a wet, tangled, and generally unmanageable state. Once the hair dries, it is often left in a dry, rough, lusterless, or frizzy condition due to removal of the hair's natural oils and other natural conditioning and moisturizing components. The hair can further be left with increased levels of static upon drying, which can interfere with combing and result in a condition commonly referred to as "fly-away hair", or contribute to an undesirable phenomena of "split ends", particularly for long hair.

A variety of approaches have been developed to alleviate these after-shampoo problems. These approaches range from post-shampoo application of hair conditioners such as leave-on and rinse-off products, to hair conditioning shampoos which attempt to both clean and condition the hair from a single product.

Although some consumers prefer the ease and convenience of a shampoo which includes conditioners, a substantial proportion of consumers prefer the more conventional conditioner formulations which are applied to the hair as a separate step from shampooing, usually subsequent to shampooing. Conditioning formulations can be in the form of rinse-off products or leave-on products, and can be in the form of an emulsion, cream, gel, spray, and mousse. Such consumers who prefer the conventional conditioner formulations value the relatively higher conditioning effect, or convenience of changing the amount of conditioning depending on the condition of hair or amount of hair.

Japanese Patent Publication (laid-open) No.10-7534 discloses a hair conditioning composition containing a cationic surfactant and an emulsion polymerized silicone emulsion. It is disclosed this composition provides shining, smoothness, softness, and free-flowing feeling to the hair.

Generally, hair conditioner compositions which provide benefits described above are also known to provide hair volume-down. For consumers who desire hair volume-up such as consumers having fine hair, the effect of hair volume-down is not desirable. The term "hair volume-up" as used herein is not equal to fly-away hair. Fly-away hair is due to the increased level of static, and represents volume increase of only very minor amount of the hair as a whole, and is not desirable. On the other hand, hair volume-up as used herein relates to increase of the bulk of the hair volume. Consumers having fine hair have the desire to achieve hair volume-up while controlling undesirable fly-away of the hair.

Based on the foregoing, there remains a desire to provide hair conditioning compositions which provide hair volume-up while not deteriorating conditioning benefits such as softness, moisturized feel, and fly-away control. There is also a desire to provide such hair conditioning compositions while maintaining acceptable rheology profiles so as to satisfactory spreadability on the hair, and so as to be made by a convenient manufacturing method.

None of the existing art provides all of the advantages and benefits of the present invention.

SUMMARY

The present invention is directed to a hair conditioning composition comprising by weight:

(a) from about 0.1% to about 20% of a cationic silicone emulsion comprising by weight of the cationic silicone emulsion from about 1% to about 20% of a cationic surfactant; and an emulsifiable amount of a silicone compound having a particle size of less than about 50 microns;

(b) from about 0.1% to about 15% of a high melting point fatty compound having a melting point of 25°C or higher;

(c) from about 0.1% to about 10% of a cationic conditioning agent; and

(d) an aqueous carrier.

These and other features, aspects, and advantages of the present invention will become evident to those skilled in the art from a reading of the present disclosure.

DETAILED DESCRIPTION

While the specification concludes with claims which particularly point out and distinctly claim the invention, it is believed the present invention will be better understood from the following description.

All cited references are incorporated herein by reference in their entireties. Citation of any reference is not an admission regarding any determination as to its availability as prior art to the claimed invention.

Herein, "comprising" means that other steps and other ingredients which do not affect the end result can be added. This term encompasses the terms "consisting of" and "consisting essentially of".

All percentages, parts and ratios are based upon the total weight of the compositions of the present invention, unless otherwise specified. All such weights as they pertain to listed ingredients are based on the active level and, therefore, do not include carriers or by-products that may be included in commercially available materials.

CATIONIC SILICONE EMULSION

The hair conditioning composition of the present invention comprises a cationic silicone emulsion. The cationic silicone emulsion herein is a pre-dispersed stable emulsion comprising at least a cationic surfactant, a silicone compound, and water.

The cationic silicone emulsion herein provides increase in bulk hair volume while not deteriorating conditioning benefits such as fly-away control. It is of particular significance that, in the present invention the cationic surfactant is present in the silicone emulsion, and not just in the bulk of the composition. Cationic surfactant is typically included in the bulk of a conditioning composition for hair conditioning benefits such as fly-away control, however can also reduce bulk hair volume. It has been surprisingly found that when cationic surfactant is included in the silicone emulsion, increase in bulk hair volume is significantly improved than when the same amount of cationic surfactant is included in the bulk of the composition.

The cationic silicone emulsion herein also provides acceptable rheology profiles in the conditioning composition of this invention, so this composition provides satisfactory spreadability on the hair, and can be made by a convenient manufacturing method.

The cationic silicone emulsion comprises, by weight of the cationic silicone emulsion, from about 1% to about 20%, preferably from about 2% to about 8%, of a cationic surfactant; and an emulsifiable amount of silicone compound. The silicone compound is preferably comprised from about 0.1% to about 70%, more preferably from about 5% to about 60% by weight of the cationic silicone emulsion. The amount of silicone compound to the entire composition is preferably from about 0.1% to about 10% by weight.

The cationic silicone emulsion is included in the composition at a level by weight from about 0.1% to about 20%, more preferably from about 0.5% to about 5%.

The cationic silicone emulsion can be made by any convenient method known in the art.

For example, the cationic silicone emulsion may be made by mechanical emulsification by taking a polysiloxane polymer and emulsifying it in water in the presence of at least one emulsifying agent using mechanical means such as agitation, shaking and homogenization. The emulsifying agent can be the cationic surfactant comprised in the cationic silicone emulsion, or other suitable surfactant. Mechanical emulsification may require use of two or more surfactants, and two or more mixing processes using different surfactants. Two or more types of silicone compounds, such as a highly viscous silicone compound and a low viscosity silicone compound, may be used. One particularly preferred process for obtaining the cationic silicone emulsion of the present invention via mechanical emulsification is through the process disclosed in EP Publication 460,683A, which is incorporated herein by reference in its entirety. In this reference, it is disclosed that the emulsion is prepared by combining the polysiloxane, water, and a primary nonionic surfactant having an HLB value of 15-19 to form a first mixture, adding to the first mixture a co-surfactant selected from the group consisting of nonionic, cationic and anionic surfactants having an HLB value of 1.8-15 to form a second mixture and mixing the second mixture at a temperature of about 40°C, until the particle size of the polysiloxane in the emulsion is less than about three hundred nanometers.

The cationic silicone emulsion herein may be made by emulsion polymerization. An emulsion polymerization process includes taking a polysiloxane monomer and/or oligomer and emulsifying it in water in the presence of a catalyst to form the polysiloxane polymer. It is understood that unreacted monomers and oligomers may remain in an emulsion polymerized

silicone emulsion. One particularly preferred process for obtaining the cationic silicone emulsion of the present invention via emulsion polymerization is through the process disclosed in GB application 2,303,857, which is incorporated herein by reference in its entirety. This reference discloses a process for making stable cationic silicone oil-in-water emulsion comprising: 1) blending a mixture of silicones selected from the group consisting of cyclic silicone oligomers, mixed silicone hydrolyzates, silanol stopped oligomers, high molecular weight silicone polymers, and functionalized silicones with 2) water, and 3) an anionic surfactant; 4) heating the blend to a temperature ranging from about 75 to about 98°C for a period of time ranging from about 1 hours to about 5 hours; 5) cooling the heated blend to a temperature ranging from 0 to about 25°C for a period of time ranging from about 3 hours to about 24 hours; 6) adding a compatibilizing surfactant selected from the group consisting of nonionic surfactant having an HLB ratio greater than 9; and 7) adding a cationic surfactant.

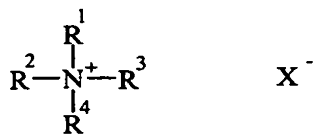
The silicone compound in the cationic silicone emulsion has a particle size of less than about 50 microns, preferably from about 0.2 to about 2.5 microns, more preferably from about 0.2 to about 0.5 microns. The particle size of the silicone compound is believed to affect the deposition of the silicone compound on the hair. The particle size of the silicone compound is determined based on the desired deposition and uniformity of distribution of the silicone compound.

The silicone particle size herein is measured by a laser analyzing equipment using Coulter Model N4SD available from Coulter Electronics, Inc. (Hialeah, FL, U.S.A.) using a spectrophotometer containing a Laser 4mW helium neon (632.8nm) and RS-232C serial interface. The particle size is analyzed via unimodal fit.

Cationic Surfactant

The cationic silicone emulsion herein comprises a cationic surfactant. The cationic surfactant useful herein is any known to the artisan, and is preferably included in the cationic silicone emulsion at a level by weight from about 1% to about 20%, more preferably from about 2% to about 8%.

Among the cationic surfactants useful herein are those corresponding to the general formula (I):



(I)

wherein at least one of R^1, R^2, R^3, and R^4 is selected from an aliphatic group of from 8 to 30 carbon atoms or an aromatic, alkoxy, polyoxyalkylene, alkylamido, hydroxyalkyl, aryl or alkylaryl group having up to about 22 carbon atoms, the remainder of R^1, R^2, R^3, and R^4 are independently selected from an aliphatic group of from 1 to about 22 carbon atoms or an aromatic, alkoxy, polyoxyalkylene, alkylamido, hydroxyalkyl, aryl or alkylaryl group having up to about 22 carbon atoms; and X is a salt-forming anion such as those selected from halogen, (e.g. chloride, bromide), acetate, citrate, lactate, glycolate, phosphate, nitrate, sulfonate, sulfate, alkylsulfate, and alkyl sulfonate radicals. The aliphatic groups can contain, in addition to carbon and hydrogen atoms, ether linkages, and other groups such as amino groups. The longer chain aliphatic groups, e.g., those of about 12 carbons, or higher, can be saturated or unsaturated. Preferred is when R^1, R^2, R^3, and R^4 are independently selected from C_1 to about C_{22} alkyl. Nonlimiting examples of cationic surfactants useful in the present invention include the materials having the following CTFA designations: quaternium-8, quaternium-14, quaternium-18, quaternium-18 methosulfate, quaternium-24, and mixtures thereof.

Among the cationic surfactants of general formula (I), preferred are those containing in the molecule at least one alkyl chain having at least 16 carbons. Nonlimiting examples of such preferred cationic surfactants include: behenyl trimethyl ammonium chloride available, for example, with tradename INCROQUAT TMC-80 from Croda and ECONOL TM22 from Sanyo Kasei; cetyl trimethyl ammonium chloride available, for example, with tradename CA-2350 from Nikko Chemicals, hydrogenated tallow alkyl trimethyl ammonium chloride,

dialkyl (14-18) dimethyl ammonium chloride, ditallow alkyl dimethyl ammonium chloride, dihydrogenated tallow alkyl dimethyl ammonium chloride, distearyl dimethyl ammonium chloride, dicetyl dimethyl ammonium chloride, di(behenyl/arachidyl) dimethyl ammonium chloride, dibehenyl dimethyl ammonium chloride, stearyl dimethyl benzyl ammonium chloride, stearyl propyleneglycol phosphate dimethyl ammonium chloride, stearoyl amidopropyl dimethyl benzyl ammonium chloride, stearoyl amidopropyl dimethyl (myristylacetate) ammonium chloride, and N-(stearoyl colamino formyl methy) pyridinium chloride.

Also preferred are hydrophilically substituted cationic surfactants in which at least one of the substituents contain one or more aromatic, ether, ester, amido, or amino moieties present as substituents or as linkages in the radical chain, wherein at least one of the R^1 - R^4 radicals contain one or more hydrophilic moieties selected from alkoxy (preferably C_1 - C_3 alkoxy), polyoxyalkylene (preferably C_1 - C_3 polyoxyalkylene), alkylamido, hydroxyalkyl, alkylester, and combinations thereof. Preferably, the hydrophilically substituted cationic conditioning surfactant contains from 2 to about 10 nonionic hydrophile moieties located within the above stated ranges. Preferred hydrophilically substituted cationic surfactants include those of the formula (II) through (VIII) below:

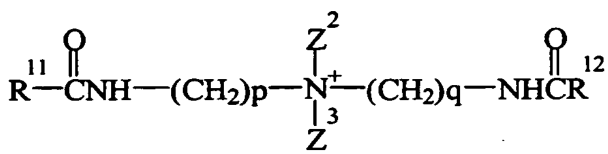
$$CH_3(CH_2)n-CH_2-\overset{\displaystyle Z^1}{\underset{\displaystyle (CH_2CH_2O)yH}{\overset{|}{\underset{|}{N^+}}}}-(CH_2CH_2O)xH \qquad X^- \qquad \text{(II)}$$

wherein n is from 8 to about 28, x+y is from 2 to about 40, Z^1 is a short chain alkyl, preferably a $C_1 - C_3$ alkyl, more preferably methyl, or $(CH_2CH_2O)_zH$ wherein x+y+z is up to 60, and X is a salt forming anion as defined above;

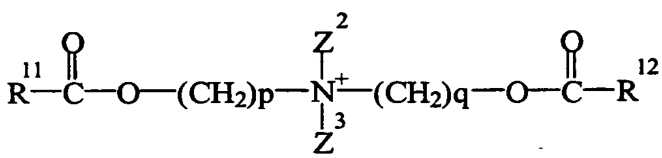
$$R^5-\overset{\displaystyle R^6}{\underset{\displaystyle R^7}{\overset{|}{\underset{|}{N^+}}}}-(CH_2)m-\overset{\displaystyle R^8}{\underset{\displaystyle R^{10}}{\overset{|}{\underset{|}{N^+}}}}-R^9 \quad . \quad 2X^- \qquad \text{(III)}$$

wherein m is 1 to 5, one or more of R^5, R^6, and R^7 are independently an C_1 - C_{30} alkyl, the remainder are CH_2CH_2OH, one or two of R^8, R^9, and R^{10} are

independently an C_1 - C_{30} alkyl, and remainder are CH_2CH_2OH, and X is a salt forming anion as mentioned above;

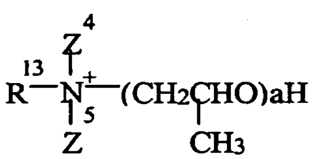


X^- (IV)



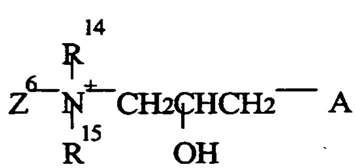
X^- (V)

wherein, independently for formulae (IV) and (V), Z^2 is an alkyl, preferably a C_1 - C_3 alkyl, more preferably methyl, and Z^3 is a short chain hydroxyalkyl, preferably hydroxymethyl or hydroxyethyl, p and q independently are integers from 2 to 4, inclusive, preferably from 2 to 3, inclusive, more preferably 2, R^{11} and R^{12}, independently, are substituted or unsubstituted hydrocarbyls, preferably C_{12} - C_{20} alkyl or alkenyl, and X is a salt forming anion as defined above;



X^- (VI)

wherein R^{13} is a hydrocarbyl, preferably a C_1 - C_3 alkyl, more preferably methyl, Z^4 and Z^5 are, independently, short chain hydrocarbyls, preferably C_2 - C_4 alkyl or alkenyl, more preferably ethyl, a is from 2 to about 40, preferably from about 7 to about 30, and X is a salt forming anion as defined above;



X^- (VII)

wherein R^{14} and R^{15}, independently, are C_1 - C_3 alkyl, preferably methyl, Z^6 is a C_{12} - C_{22} hydrocarbyl, alkyl carboxy or alkylamido, and A is a protein, preferably a collagen, keratin, milk protein, silk, soy protein, wheat protein, or hydrolyzed forms thereof; and X is a salt forming anion as defined above;

$$HOCH_2-(CHOH)_4-\overset{\displaystyle O}{\overset{\|}{C}}NH(CH_2)_b-\overset{\displaystyle R^{16}}{\overset{|}{\underset{\underset{\displaystyle R^{17}}{|}}{N^{+}}}}-CH_2CH_2OH \quad X^{-} \qquad (VIII)$$

wherein b is 2 or 3, R^{16} and R^{17}, independently are C_1 - C_3 hydrocarbyls preferably methyl, and X is a salt forming anion as defined above. Nonlimiting examples of hydrophilically substituted cationic surfactants useful in the present invention include the materials having the following CTFA designations: quaternium-16, quaternium-26, quaternium-27, quaternium-30, quaternium-33, quaternium-43, quaternium-52, quaternium-53, quaternium-56, quaternium-60, quaternium-61, quaternium-62, quaternium-70, quaternium-71, quaternium-72, quaternium-75, quaternium-76 hydrolyzed collagen, quaternium-77, quaternium-78, quaternium-79 hydrolyzed collagen, quaternium-79 hydrolyzed keratin, quaternium-79 hydrolyzed milk protein, quaternium-79 hydrolyzed silk, quaternium-79 hydrolyzed soy protein, and quaternium-79 hydrolyzed wheat protein, quaternium-80, quaternium-81, quaternium-82, quaternium-83, quaternium-84, and mixtures thereof.

Highly preferred hydrophilically substituted cationic surfactants include dialkylamido ethyl hydroxyethylmonium salt, dialkylamidoethyl dimonium salt, dialkyloyl ethyl hydroxyethylmonium salt, dialkyloyl ethyldimonium salt, and mixtures thereof; for example, commerically available under the following tradenames; VARISOFT 110, VARIQUAT K1215 and 638 from Witco Chemical, MACKPRO KLP, MACKPRO WLW, MACKPRO MLP, MACKPRO NSP, MACKPRO NLW, MACKPRO WWP, MACKPRO NLP, MACKPRO SLP from McIntyre, ETHOQUAD 18/25, ETHOQUAD O/12PG, ETHOQUAD C/25, ETHOQUAD S/25, and ETHODUOQUAD from Akzo, DEHYQUAT SP from Henkel, and ATLAS G265 from ICI Americas.

Salts of primary, secondary, and tertiary fatty amines are also suitable cationic surfactants. The alkyl groups of such amines preferably have from about 12 to about 22 carbon atoms, and can be substituted or unsubstituted. Particularly useful are amidoamines of the following general formula:

$$R^1\ CONH\ (CH_2)_m\ N\ (R^2)_2$$

wherein R^1 is a residue of C_{11} to C_{24} fatty acids, R^2 is a C_1 to C_4 alkyl, and m is an integer from 1 to 4.

Preferred amidoamine useful in the present invention includes stearamidopropyldimethylamine, stearamidopropyldiethylamine, stearamidoethyldiethylamine, stearamidoethyldimethylamine, palmitamidopropyldimethylamine, palmitamidopropyldiethylamine, palmitamidoethyldiethylamine, palmitamidoethyldimethylamine, behenamidopropyldimethylamine, behenamidopropyldiethylamine, behenamidoethyldiethylamine, behenamidoethyldimethylamine, arachidamidopropyldimethylamine, arachidamidopropyldiethylamine, arachidamidoethyldiethylamine, arachidamidoethyldimethylamine, and mixtures thereof; more preferably stearamidopropyldimethylamine, stearamidoethyldiethylamine, and mixtures thereof.

The amidoamines herein are preferably partially quaternized with the acids selected from the group consisting of L-glutamic acid, lactic acid, hydrochloric acid, malic acid, succinic acid, acetic acid, fumaric acid, L-glutamic acid hydrochloride, tartaric acid, and mixtures thereof; preferably L-glutamic acid, lactic acid, hydrochloric acid, and mixtures thereof.

Preferably, the mole ratio of amidoamine to acid is from about 1:0.3 to about 1:1, more preferably from about 1:0.5 to about 1:0.9.

Silicone Compound

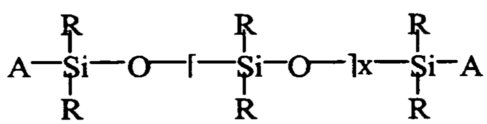
The cationic silicone emulsion herein comprises a silicone compound in an amount capable of providing a stable emulsion, preferably from about 0.1% to about 70%, more preferably from about 5% to about 60% by weight of the cationic silicone emulsion. The amount of silicone compound to the entire composition is preferably from about 0.1% to about 10% by weight. The silicone compounds hereof can include volatile soluble or insoluble, or nonvolatile soluble or insoluble silicone conditioning agents. By soluble what is meant is that the silicone compound is miscible with the carrier of the composition so as to form part of the same phase. By insoluble what is meant is that the silicone forms a separate, discontinuous phase from the carrier, such as in the form of an emulsion or a suspension of droplets of the silicone. The silicone compounds herein may be made by conventional polymerization, or emulsion polymerization.

The silicone compounds for use herein will preferably have a viscosity of from about 1,000 to about 2,000,000 centistokes at 25^{o}C, more preferably from about 10,000 to about 1,800,000, and even more preferably from about 25,000 to about 1,500,000. The viscosity can be measured by means of a glass capillary viscometer as set forth in Dow Corning Corporate Test Method

CTM0004, July 20, 1970, which is incorporated by reference herein in its entirety. Silicone compound of high molecular weight may be made by emulsion polymerization.

Silicone compounds useful herein include polyalkyl polyaryl siloxanes, polyalkyleneoxide-modified siloxanes, silicone resins, amino-substituted siloxanes, and mixtures thereof. The silicone compound is preferably selected from the group consisting of polyalkyl polyaryl siloxanes, polyalkyleneoxide-modified siloxanes, silicone resins, and mixtures thereof, and more preferably from one or more polyalkyl polyaryl siloxanes.

Polyalkyl polyaryl siloxanes useful here in include those with the following structure (I)



(I)

wherein R is alkyl or aryl, and x is an integer from about 7 to about 8,000. "A" represents groups which block the ends of the silicone chains. The alkyl or aryl groups substituted on the siloxane chain (R) or at the ends of the siloxane chains (A) can have any structure as long as the resulting silicone remains fluid at room temperature, is dispersible, is neither irritating, toxic nor otherwise harmful when applied to the hair, is compatible with the other components of the composition, is chemically stable under normal use and storage conditions, and is capable of being deposited on and conditions the hair. Suitable A groups include hydroxy, methyl, methoxy, ethoxy, propoxy, and aryloxy. The two R groups on the silicon atom may represent the same group or different groups. Preferably, the two R groups represent the same group. Suitable R groups include methyl, ethyl, propyl, phenyl, methylphenyl and phenylmethyl. The preferred silicone compounds are polydimethylsiloxane, polydiethylsiloxane, and polymethylphenylsiloxane. Polydimethylsiloxane, which is also known as dimethicone, is especially preferred. The polyalkylsiloxanes that can be used include, for example, polydimethylsiloxanes. These silicone compounds are available, for example, from the General Electric Company in their ViscasilR and SF 96 series, and from Dow Corning in their Dow Corning 200 series. Polymethylphenylsiloxanes, for example, from the General Electric Company as

SF 1075 methyl phenyl fluid or from Dow Corning as 556 Cosmetic Grade Fluid, are useful herein.

Also preferred, for enhancing the shine characteristics of hair, are highly arylated silicone compounds, such as highly phenylated polyethyl silicone having refractive index of about 1.46 or higher, especially about 1.52 or higher. When these high refractive index silicone compounds are used, they should be mixed with a spreading agent, such as a surfactant or a silicone resin, as described below to decrease the surface tension and enhance the film forming ability of the material.

Another polyalkyl polyaryl siloxane that can be especially useful is a silicone gum. The term "silicone gum", as used herein, means a polyorganosiloxane material having a viscosity at 25°C of greater than or equal to 1,000,000 centistokes. It is recognized that the silicone gums described herein can also have some overlap with the above-disclosed silicone compounds. This overlap is not intended as a limitation on any of these materials. Silicone gums are described by Petrarch, and others including U.S. Patent No. 4,152,416, to Spitzer et al., issued May 1, 1979 and Noll, Walter, Chemistry and Technology of Silicones, New York: Academic Press 1968. Also describing silicone gums are General Electric Silicone Rubber Product Data Sheets SE 30, SE 33, SE 54 and SE 76. All of these described references are incorporated herein by reference in their entirety. The "silicone gums" will typically have a mass molecular weight in excess of about 200,000, generally between about 200,000 and about 1,000,000. Specific examples include polydimethylsiloxane, poly(dimethylsiloxane methylvinylsiloxane) copolymer, poly(dimethylsiloxane diphenylsiloxane methylvinylsiloxane) copolymer and mixtures thereof.

Polyalkyleneoxide-modified siloxanes useful herein include, for example, polypropylene oxide modified and polyethylene oxide modified polydimethylsiloxane. The ethylene oxide and polypropylene oxide level should be sufficiently low so as not to interfere with the dispersibility characteristics of the silicone. These material are also known as dimethicone copolyols.

Silicone resins, which are highly crosslinked polymeric siloxane systems, are useful herein. The crosslinking is introduced through the incorporation of tri-functional and tetra-functional silanes with mono-functional or di-functional, or both, silanes during manufacture of the silicone resin. As is well understood in the art, the degree of crosslinking that is required in order to result in a silicone resin will vary according to the specific silane units incorporated into the silicone

resin. In general, silicone materials which have a sufficient level of trifunctional and tetrafunctional siloxane monomer units, and hence, a sufficient level of crosslinking, such that they dry down to a rigid, or hard, film are considered to be silicone resins. The ratio of oxygen atoms to silicon atoms is indicative of the level of crosslinking in a particular silicone material. Silicone materials which have at least about 1.1 oxygen atoms per silicon atom will generally be silicone resins herein. Preferably, the ratio of oxygen:silicon atoms is at least about 1.2:1.0. Silanes used in the manufacture of silicone resins include monomethyl-, dimethyl-, trimethyl-, monophenyl-, diphenyl-, methylphenyl-, monovinyl-, and methylvinylchlorosilanes, and tetrachlorosilane, with the methyl substituted silanes being most commonly utilized. Preferred resins are offered by General Electric as GE SS4230 and SS4267. Commercially available silicone resins will generally be supplied in a dissolved form in a low viscosity volatile or nonvolatile silicone fluid. The silicone resins for use herein should be supplied and incorporated into the present compositions in such dissolved form, as will be readily apparent to those skilled in the art. Without being bound by theory, it is believed that the silicone resins can enhance deposition of other silicone compounds on the hair and can enhance the glossiness of hair with high refractive index volumes.

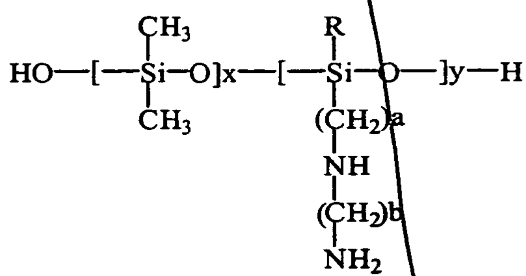
Other useful silicone resins are silicone resin powders such as the material given the CTFA designation polymethylsilsequioxane, which is commercially available as Tospearl™ from Toshiba Silicones.

Silicone resins can conveniently be identified according to a shorthand nomenclature system well known to those skilled in the art as the "MDTQ" nomenclature. Under this system, the silicone is described according to the presence of various siloxane monomer units which make up the silicone. Briefly, the symbol M denotes the mono-functional unit $(CH_3)_3SiO)_{.5}$; D denotes the difunctional unit $(CH_3)_2SiO$; T denotes the trifunctional unit $(CH_3)SiO_{1.5}$; and Q denotes the quadri- or tetra-functional unit SiO_2. Primes of the unit symbols, e.g., M', D', T', and Q' denote substituents other than methyl, and must be specifically defined for each occurrence. Typical alternate substituents include groups such as vinyl, phenyl, amino, hydroxyl, etc. The molar ratios of the various units, either in terms of subscripts to the symbols indicating the total number of each type of unit in the silicone, or an average thereof, or as specifically indicated ratios in combination with molecular weight, complete the description of the silicone material under the MDTQ system. Higher relative

molar amounts of T, Q, T' and/or Q' to D, D', M and/or or M' in a silicone resin is indicative of higher levels of crosslinking. As discussed before, however, the overall level of crosslinking can also be indicated by the oxygen to silicon ratio.

The silicone resins for use herein which are preferred are MQ, MT, MTQ, MQ and MDTQ resins. Thus, the preferred silicone substituent is methyl. Especially preferred are MQ resins wherein the M:Q ratio is from about 0.5:1.0 to about 1.5:1.0 and the average molecular weight of the resin is from about 1000 to about 10,000.

Amino-substituted siloxanes useful herein include those represented by the following structure (II)



(II)

wherein R is CH_3 or OH, x and y are integers which depend on the molecular weight, the average molecular weight being approximately between 5,000 and 10,000. This polymer is also known as "amodimethicone".

Suitable amino-substituted siloxane fluids include those represented by the formula (III)

$$(R_1)_aG_{3-a}\text{-Si-(-OSiG}_2)_n\text{-(-OSiG}_b(R_1)_{2-b})_m\text{-O-SiG}_{3-a}(R_1)_a \qquad \text{(III)}$$

in which G is chosen from the group consisting of hydrogen, phenyl, OH, C_1-C_8 alkyl and preferably methyl; a denotes 0 or an integer from 1 to 3, and preferably equals 0; b denotes 0 or 1 and preferably equals 1; the sum n+m is a number from 1 to 2,000 and preferably from 50 to 150, n being able to denote a number from 0 to 1,999 and preferably from 49 to 149 and m being able to denote an integer from 1 to 2,000 and preferably from 1 to 10; R_1 is a monovalent radical of formula $C_qH_{2q}L$ in which q is an integer from 2 to 8 and L is chosen from the groups

$-N(R_2)CH_2-CH_2-N(R_2)_2$

$-N(R_2)_2$

$-N(R_2)_3A^-$

$-N(R_2)CH_2-CH_2-NR_2H_2A^-$

in which R_2 is chosen from the group consisting of hydrogen, phenyl, benzyl, a saturated hydrocarbon radical, preferably an alkyl radical containing from 1 to 20 carbon atoms, and A^- denotes a halide ion.

An especially preferred amino-substituted siloxane corresponding to formula (III) is the polymer known as "trimethylsilylamodimethicone", of formula (IV):

$$(CH_3)_3Si-O[-\underset{CH_3}{\overset{CH_3}{Si}}-O-]_n-[-\underset{\underset{\underset{\underset{NH_2}{|}}{(CH_2)_b}}{\underset{|}{NH}}}{\underset{|}{(CH_2)_a}}}{\overset{CH_3}{Si}}-O-]_m-Si(CH_3)_3 \qquad (IV)$$

In this formula n and m are selected depending on the molecular weight of the compound desired.

Other amino-substituted siloxane which can be used are represented by the formula (V):

$$(R^3)_3Si-O-[-\underset{R^3}{\overset{R^4CH_2-CHOH-CH_2-N^+(R^3)_3Q^-}{Si}}-O-]_r-[-\underset{R^3}{\overset{R^3}{Si}}-O-]_s-Si(R^3)_3 \qquad (V)$$

where R^3 denotes a monovalent hydrocarbon radical having from 1 to 18 carbon atoms, preferably an alkyl or alkenyl radical such as methyl; R_4 denotes a hydrocarbon radical, preferably a $C_1 - C_{18}$ alkylene radical or a $C_1 - C_{18}$, and more preferably $C_1 - C_8$, alkyleneoxy radical; Q^- is a halide ion, preferably chloride; r denotes an average statistical value from 2 to 20, preferably from 2 to 8; s denotes an average statistical value from 20 to 200, and preferably from 20 to 50. A preferred polymer of this class is available from Union Carbide under the name "UCAR SILICONE ALE 56."

HIGH MELTING POINT FATTY COMPOUND

The composition of the present invention comprises a high melting point fatty compound. The high melting point fatty compound useful herein have a melting point of 25°C or higher, and is selected from the group consisting of fatty alcohols, fatty acids, fatty alcohol derivatives, fatty acid derivatives, and mixtures thereof. It is understood by the artisan that the compounds disclosed in this section of the specification can in some instances fall into more than one classification, *e.g.*, some fatty alcohol derivatives can also be classified as fatty acid derivatives. However, a given classification is not intended to be a limitation on that particular compound, but is done so for convenience of classification and nomenclature. Further, it is understood by the artisan that, depending on the number and position of double bonds, and length and position of the branches, certain compounds having certain required carbon atoms may have a melting point of less than 25°C. Such compounds of low melting point are not intended to be included in this section. Nonlimiting examples of the high melting point compounds are found in International Cosmetic Ingredient Dictionary, Fifth Edition, 1993, and CTFA Cosmetic Ingredient Handbook, Second Edition, 1992.

These high melting point fatty compounds, together with the cationic conditioning agent, provide a gel network suitable for providing various conditioning benefits such as slippery and slick feel on wet hair, and softness, moisturized feel, and fly-away control on dry hair.

The high melting point fatty compound is included in the composition at a level by weight of from about 0.1% to about 15%, preferably from about 0.5% to about 10%, more preferably from about 1% to about 7%.

The fatty alcohols useful herein are those having from about 14 to about 30 carbon atoms, preferably from about 16 to about 22 carbon atoms. These fatty alcohols are saturated and can be straight or branched chain alcohols. Nonlimiting examples of fatty alcohols include, cetyl alcohol, stearyl alcohol, behenyl alcohol, and mixtures thereof.

The fatty acids useful herein are those having from about 10 to about 30 carbon atoms, preferably from about 12 to about 22 carbon atoms, and more preferably from about 16 to about 22 carbon atoms. These fatty acids are saturated and can be straight or branched chain acids. Also included are diacids, triacids, and other multiple acids which meet the requirements herein. Also included herein are salts of these fatty acids. Nonlimiting examples of fatty

acids include lauric acid, palmitic acid, stearic acid, behenic acid, sebacic acid, and mixtures thereof.

The fatty alcohol derivatives and fatty acid derivatives useful herein include alkyl ethers of fatty alcohols, alkoxylated fatty alcohols, alkyl ethers of alkoxylated fatty alcohols, esters of fatty alcohols, fatty acid esters of compounds having esterifiable hydroxy groups, hydroxy-substituted fatty acids, and mixtures thereof. Nonlimiting examples of fatty alcohol derivatives and fatty acid derivatives include materials such as methyl stearyl ether; the ceteth series of compounds such as ceteth-1 through ceteth-45, which are ethylene glycol ethers of cetyl alcohol, wherein the numeric designation indicates the number of ethylene glycol moieties present; the steareth series of compounds such as steareth-1 through 10, which are ethylene glycol ethers of steareth alcohol, wherein the numeric designation indicates the number of ethylene glycol moieties present; ceteareth 1 through ceteareth-10, which are the ethylene glycol ethers of ceteareth alcohol, *i.e.* a mixture of fatty alcohols containing predominantly cetyl and stearyl alcohol, wherein the numeric designation indicates the number of ethylene glycol moieties present; C_1-C_{30} alkyl ethers of the ceteth, steareth, and ceteareth compounds just described; polyoxyethylene ethers of behenyl alcohol; ethyl stearate, cetyl stearate, cetyl palmitate, stearyl stearate, myristyl myristate, polyoxyethylene cetyl ether stearate, polyoxyethylene stearyl ether stearate, polyoxyethylene lauryl ether stearate, ethyleneglycol monostearate, polyoxyethylene monostearate, polyoxyethylene distearate, propyleneglycol monostearate, propyleneglycol distearate, trimethylolpropane distearate, sorbitan stearate, polyglyceryl stearate, glyceryl monostearate, glyceryl distearate, glyceryl tristearate, and mixtures thereof.

High melting point fatty compounds of a single compound of high purity are preferred. Single compounds of pure fatty alcohols selected from the group of pure cetyl alcohol, stearyl alcohol, and behenyl alcohol are highly preferred. By "pure" herein, what is meant is that the compound has a purity of at least about 90%, preferably at least about 95%. These single compounds of high purity provide good rinsability from the hair when the consumer rinses off the composition.

Commercially available high melting point fatty compounds useful herein include: cetyl alcohol, stearyl alcohol, and behenyl alcohol having tradenames KONOL series available from Shin Nihon Rika (Osaka, Japan), and NAA series available from NOF (Tokyo, Japan); pure behenyl alcohol having tradename 1-

DOCOSANOL available from WAKO (Osaka, Japan), various fatty acids having tradenames NEO-FAT available from Akzo (Chicago Illinois, USA), HYSTRENE available from Witco Corp. (Dublin Ohio, USA), and DERMA available from Vevy (Genova, Italy).

CATIONIC CONDITIONING AGENT

The composition of the present invention comprises a cationic conditioning agent. This cationic conditioning agent, together with the high melting point fatty compounds, provide a gel network suitable for providing various conditioning benefits such as slippery and slick feel on wet hair, and such as softness, moisturized feel, and fly-away control on dry hair.

The cationic conditioning agent is included in the composition at a level by weight of from about 0.1% to about 10%, preferably from about 0.25% to about 8%, more preferably from about 0.5% to about 3%.

The cationic conditioning agent is selected from the group consisting of cationic surfactants, cationic polymers, and mixtures thereof.

Cationic Surfactant

The cationic surfactant useful herein is any known to the artisan, and is selected from the species disclosed above under the title "Cationic Surfactant".

Cationic Polymer

The cationic polymer useful herein is described below. As used herein, the term "polymer" shall include materials whether made by polymerization of one type of monomer or made by two (i.e., copolymers) or more types of monomers.

Preferably, the cationic polymer is a water-soluble cationic polymer. By "water soluble" cationic polymer, what is meant is a polymer which is sufficiently soluble in water to form a substantially clear solution to the naked eye at a concentration of 0.1% in water (distilled or equivalent) at 25°C. The preferred polymer will be sufficiently soluble to form a substantially clear solution at 0.5% concentration, more preferably at 1.0% concentration.

The cationic polymers hereof will generally have a weight average molecular weight which is at least about 5,000, typically at least about 10,000, and is less than about 10 million. Preferably, the molecular weight is from about 100,000 to about 2 million. The cationic polymers will generally have cationic nitrogen-containing moieties such as quaternary ammonium or cationic amino moieties, and mixtures thereof.

The cationic charge density is preferably at least about 0.1 meq/gram, more preferably at least about 1.5 meq/gram, even more preferably at least about 1.1 meq/gram, still more preferably at least about 1.2 meq/gram. Cationic charge density of the cationic polymer can be determined according to the Kjeldahl Method. Those skilled in the art will recognize that the charge density of amino-containing polymers may vary depending upon pH and the isoelectric point of the amino groups. The charge density should be within the above limits at the pH of intended use.

Any anionic counterions can be utilized for the cationic polymers so long as the water solubility criteria is met. Suitable counterions include halides (e.g., Cl, Br, I, or F, preferably Cl, Br, or I), sulfate, and methylsulfate. Others can also be used, as this list is not exclusive.

The cationic nitrogen-containing moiety will be present generally as a substituent, on a fraction of the total monomer units of the cationic hair conditioning polymers. Thus, the cationic polymer can comprise copolymers, terpolymers, etc. of quaternary ammonium or cationic amine-substituted monomer units and other non-cationic units referred to herein as spacer monomer units. Such polymers are known in the art, and a variety can be found in the CTFA Cosmetic Ingredient Dictionary, 3rd edition, edited by Estrin, Crosley, and Haynes, (The Cosmetic, Toiletry, and Fragrance Association, Inc., Washington, D.C., 1982).

Suitable cationic polymers include, for example, copolymers of vinyl monomers having cationic amine or quaternary ammonium functionalities with water soluble spacer monomers such as acrylamide, methacrylamide, alkyl and dialkyl acrylamides, alkyl and dialkyl methacrylamides, alkyl acrylate, alkyl methacrylate, vinyl caprolactone, and vinyl pyrrolidone. The alkyl and dialkyl substituted monomers preferably have C_1 - C_7 alkyl groups, more preferably C_1 - C_3 alkyl groups. Other suitable spacer monomers include vinyl esters, vinyl alcohol (made by hydrolysis of polyvinyl acetate), maleic anhydride, propylene glycol, and ethylene glycol.

The cationic amines can be primary, secondary, or tertiary amines, depending upon the particular species and the pH of the composition. In general, secondary and tertiary amines, especially tertiary amines, are preferred.

Amine-substituted vinyl monomers can be polymerized in the amine form, and then optionally can be converted to ammonium by a quaternization reaction. Amines can also be similarly quaternized subsequent to formation of the

polymer. For example, tertiary amine functionalities can be quaternized by reaction with a salt of the formula R'X wherein R' is a short chain alkyl, preferably a C_1 - C_7 alkyl, more preferably a C_1 - C_3 alkyl, and X is an anion which forms a water soluble salt with the quaternized ammonium.

Suitable cationic amino and quaternary ammonium monomers include, for example, vinyl compounds substituted with dialkylaminoalkyl acrylate, dialkylaminoalkyl methacrylate, monoalkylaminoalkyl acrylate, monoalkylaminoalkyl methacrylate, trialkyl methacryloxyalkyl ammonium salt, trialkyl acryloxyalkyl ammonium salt, diallyl quaternary ammonium salts, and vinyl quaternary ammonium monomers having cyclic cationic nitrogen-containing rings such as pyridinium, imidazolium, and quaternized pyrrolidone, e.g., alkyl vinyl imidazolium, alkyl vinyl pyridinium, alkyl vinyl pyrrolidone salts. The alkyl portions of these monomers are preferably lower alkyls such as the C_1 - C_3 alkyls, more preferably C_1 and C_2 alkyls. Suitable amine-substituted vinyl monomers for use herein include dialkylaminoalkyl acrylate, dialkylaminoalkyl methacrylate, dialkylaminoalkyl acrylamide, and dialkylaminoalkyl methacrylamide, wherein the alkyl groups are preferably C_1 - C_7 hydrocarbyls, more preferably C_1 - C_3, alkyls.

The cationic polymers hereof can comprise mixtures of monomer units derived from amine- and/or quaternary ammonium-substituted monomer and/or compatible spacer monomers.

Suitable cationic hair conditioning polymers include, for example: copolymers of 1-vinyl-2-pyrrolidone and 1-vinyl-3-methylimidazolium salt (e.g., chloride salt) (referred to in the industry by the Cosmetic, Toiletry, and Fragrance Association, "CTFA", as Polyquaternium-16), such as those commercially available from BASF Wyandotte Corp. (Parsippany, NJ, USA) under the LUVIQUAT tradename (e.g., LUVIQUAT FC 370); copolymers of 1-vinyl-2-pyrrolidone and dimethylaminoethyl methacrylate (referred to in the industry by CTFA as Polyquaternium-11) such as those commercially available from Gaf Corporation (Wayne, NJ, USA) under the GAFQUAT tradename (e.g., GAFQUAT 755N); cationic diallyl quaternary ammonium-containing polymers, including, for example, dimethyldiallylammonium chloride homopolymer and copolymers of acrylamide and dimethyldiallylammonium chloride, referred to in the industry (CTFA) as Polyquaternium 6 and Polyquaternium 7, respectively; and mineral acid salts of amino-alkyl esters of homo- and co-polymers of unsaturated carboxylic acids having from 3 to 5 carbon atoms, as described in U.S. Patent 4,009,256, incorporated herein by reference.

Other cationic polymers that can be used include polysaccharide polymers, such as cationic cellulose derivatives and cationic starch derivatives.

Cationic polysaccharide polymers materials suitable for use herein include those of the formula:

$$A-O-(R-\overset{\displaystyle R^1}{\underset{\displaystyle R^2}{\overset{|}{\underset{|}{N^+}}}}-R^3) \qquad X^-$$

wherein: A is an anhydroglucose residual group, such as a starch or cellulose anhydroglucose residual, R is an alkylene oxyalkylene, polyoxyalkylene, or hydroxyalkylene group, or combination thereof, R^1, R^2, and R^3 independently are alkyl, aryl, alkylaryl, arylalkyl, alkoxyalkyl, or alkoxyaryl groups, each group containing up to about 18 carbon atoms, and the total number of carbon atoms for each cationic moiety (i.e., the sum of carbon atoms in R^1, R^2 and R^3) preferably being about 20 or less, and X is an anionic counterion, as previously described.

Cationic cellulose is available from Amerchol Corp. (Edison, NJ, USA) in their Polymer JR® and LR® series of polymers, as salts of hydroxyethyl cellulose reacted with trimethyl ammonium substituted epoxide, referred to in the industry (CTFA) as Polyquaternium 10. Another type of cationic cellulose includes the polymeric quaternary ammonium salts of hydroxyethyl cellulose reacted with lauryl dimethyl ammonium-substituted epoxide, referred to in the industry (CTFA) as Polyquaternium 24. These materials are available from Amerchol Corp. (Edison, NJ, USA) under the tradename Polymer LM-200®.

Other cationic polymers that can be used include cationic guar gum derivatives, such as guar hydroxypropyltrimonium chloride (commercially available from Celanese Corp. in their Jaguar R series). Other materials include quaternary nitrogen-containing cellulose ethers (e.g., as described in U.S. Patent 3,962,418, incorporated herein by reference), and copolymers of etherified cellulose and starch (e.g., as described in U.S. Patent 3,958,581, incorporated herein by reference.)

<u>AQUEOUS CARRIER</u>

The composition of the present invention comprises an aqueous carrier. The level and species of the carrier are selected according to the compatibility with other components, and other desired characteristic of the product.

The carrier useful in the present invention include water and water solutions of lower alkyl alcohols and polyhydric alcohols. The lower alkyl alcohol useful herein are monohydric alcohols having 1 to 6 carbons, more preferably ethanol and isopropanol. The polyhydric alcohols useful herein include propylene glycol, hexylene glycol, glycerin, and propane diol.

Preferably, the aqueous carrier is substantially water. Deionized water is preferably used. Water from natural sources including mineral cations can also be used, depending on the desired characteristic of the product. Generally, the compositions of the present invention comprise from about 20% to about 95%, preferably from about 30% to about 92%, and more preferably from about 50% to about 90% water.

LOW MELTING POINT OIL

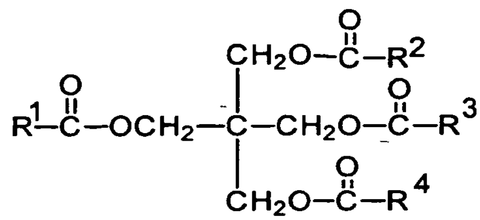
The hair conditioning composition of the present invention may further comprise a low melting point oil, which has a melting point of less than 25°C, and is preferably included in the composition at a level by weight of from about 0.1% to about 10%, more preferably from about 0.25% to about 6%.

The low melting point oil useful herein is selected from the group consisting of hydrocarbon having from 10 to about 40 carbon atoms, unsaturated fatty alcohols having from about 10 to about 30 carbon atoms, unsaturated fatty acids having from about 10 to about 30 carbon atoms, fatty acid derivatives, fatty alcohol derivatives, ester oils, poly α-olefin oils, and mixtures thereof.

Fatty alcohols useful herein include those having from about 10 to about 30 carbon atoms, preferably from about 12 to about 22 carbon atoms, and more preferably from about 16 to about 22 carbon atoms. These fatty alcohols are unsaturated and can be straight or branched chain alcohols. Suitable fatty alcohols include, for example, oleyl alcohol, isostearyl alcohol, tridecylalcohol, decyl tetradecyl alcohol, and octyl dodecyl alcohol. These alcohols are available, for example, from Shinnihon Rika.

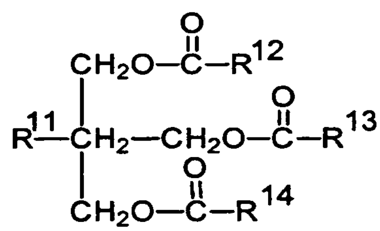
Low melting point oils useful herein include pentaerythritol ester oils, trimethylol ester oils, poly α-olefin oils, citrate ester oils, glyceryl ester oils, and mixtures thereof, and the ester oil useful herein is water-insoluble. As used herein, the term "water-insoluble" means the compound is substantially not soluble in water at 25°C; when the compound is mixed with water at a concentration by weight of above 1.0%, preferably at above 0.5%, the compound is temporarily dispersed to form an unstable colloid in water, then is quickly separated from water into two phases.

Pentaerythritol ester oils useful herein are those having the following formula:



wherein R^1, R^2, R^3, and R^4, independently, are branched, straight, saturated, or unsaturated alkyl, aryl, and alkylaryl groups having from 1 to about 30 carbons. Preferably, R^1, R^2, R^3, and R^4, independently, are branched, straight, saturated, or unsaturated alkyl groups having from about 8 to about 22 carbons. More preferably, R^1, R^2, R^3 and R^4 are defined so that the molecular weight of the compound is from about 800 to about 1200.

Trimethylol ester oils useful herein are those having the following formula:



wherein R^{11} is an alkyl group having from 1 to about 30 carbons, and R^{12}, R^{13}, and R^{14}, independently, are branched, straight, saturated, or unsaturated alkyl, aryl, and alkylaryl groups having from 1 to about 30 carbons. Preferably, R^{11} is ethyl and R^{12}, R^{13}, and R^{14}, independently, are branched, straight, saturated, or unsaturated alkyl groups having from 8 to about 22 carbons. More preferably, R^{11}, R^{12}, R^{13} and R^{14} are defined so that the molecular weight of the compound is from about 800 to about 1200.

Particularly useful pentaerythritol ester oils and trimethylol ester oils herein include pentaerythritol tetraisostearate, pentaerythritol tetraoleate, trimethylolpropane triisostearate, trimethylolpropane trioleate, and mixtures thereof. Such compounds are available from Kokyo Alcohol with tradenames KAKPTI, KAKTTI, and Shin-nihon Rika with tradenames PTO, ENUJERUBU TP3SO.

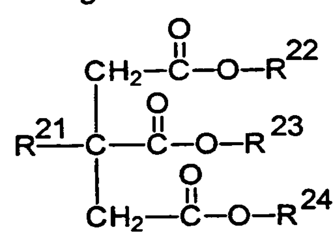
Poly α-olefin oils useful herein are those derived from 1-alkene monomers having from about 6 to about 16 carbons, preferably from about 6 to about 12 carbons atoms. Nonlimiting examples of 1-alkene monomers useful for

preparing the poly α-olefin oils include 1-hexene, 1-octene, 1-decene, 1-dodecene, 1-tetradecene, 1-hexadecene, branched isomers such as 4-methyl-1-pentene, and mixtures thereof. Preferred 1-alkene monomers useful for preparing the poly α-olefin oils are 1-octene, 1-decene, 1-dodecene, 1-tetradecene, 1-hexadecene, and mixtures thereof. Poly α-olefin oils useful herein further have a viscosity of from about 1 to about 35,000 cst, a molecular weight of from about 200 to about 60,000, and a polydispersity of no more than about 3.

Poly α-olefin oils having a molecular weight of at least about 800 are useful herein. Such high molecular weight poly α-olefin oils are believed to provide long lasting moisturized feel to the hair. Poly α-olefin oils having a molecular weight of less than about 800 are useful herein. Such low molecular weight poly α-olefin oils are believed to provide a smooth, light, clean feel to the hair.

Particularly useful poly α-olefin oils herein include polydecenes with tradenames PURESYN 6 having a number average molecular weight of about 500 and PURESYN 100 having a number average molecular weight of about 3000 and PURESYN 300 having a number average molecular weight of about 6000 available from Mobil Chemical Co.

Citrate ester oils useful herein are those having a molecular weight of at least about 500 having the following formula:

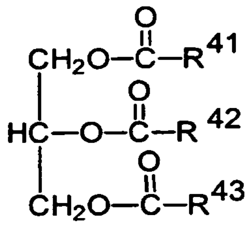


wherein R^{21} is OH or CH_3COO, and R^{22}, R^{23}, and R^{24}, independently, are branched, straight, saturated, or unsaturated alkyl, aryl, and alkylaryl groups having from 1 to about 30 carbons. Preferably, R^{21} is OH, and R^{22}, R^{23}, and R^{24}, independently, are branched, straight, saturated, or unsaturated alkyl, aryl, and alkylaryl groups having from 8 to about 22 carbons. More preferably, R^{21}, R^{22}, R^{23} and R^{24} are defined so that the molecular weight of the compound is at least about 800.

Particularly useful citrate ester oils herein include triisocetyl citrate with tradename CITMOL 316 available from Bernel, triisostearyl citrate with

tradename PELEMOL TISC available from Phoenix, and trioctyldodecyl citrate with tradename CITMOL 320 available from Bernel.

Glyceryl ester oils useful herein are those having a molecular weight of at least about 500 and having the following formula:



wherein R^{41}, R^{42}, and R^{43}, independently, are branched, straight, saturated, or unsaturated alkyl, aryl, and alkylaryl groups having from 1 to about 30 carbons. Preferably, R^{41}, R^{42}, and R^{43}, independently, are branched, straight, saturated, or unsaturated alkyl, aryl, and alkylaryl groups having from 8 to about 22 carbons. More preferably, R^{41}, R^{42}, and R^{43} are defined so that the molecular weight of the compound is at least about 800.

Particularly useful glyceryl ester oils herein include triisostearin with tradename SUN ESPOL G-318 available from Taiyo Kagaku, triolein with tradename CITHROL GTO available from Croda Surfactants Ltd., trilinolein with tradename EFADERMA-F available from Vevy, or tradename EFA-GLYCERIDES from Brooks.

POLYETHYLENE GLYCOL

The composition of present invention may further comprise a polyethylene glycol having the formula:

$$H(OCH_2CH_2)_n\text{-}OH$$

wherein n has an average value of from 2,000 to 14,000, preferably from about 5,000 to about 9,000, more preferably from about 6,000 to about 8,000.

The polyethylene glycol is preferably included in the composition at a level by weight of from about 0.1% to about 10%, more preferably from about 0.25% to about 6%.

The polyethylene glycol described above is also known as a polyethylene oxide, and polyoxyethylene. Polyethylene glycols useful herein that are especially preferred are PEG-2M wherein n has an average value of about 2,000 (PEG-2M is also known as Polyox WSR® N-10 from Union Carbide and as PEG-2,000); PEG-5M wherein n has an average value of about 5,000 (PEG-5M is also known as Polyox WSR® N-35 and as Polyox WSR® N-80, both from Union

Carbide and as PEG-5,000 and Polyethylene Glycol 300,000); PEG-7M wherein n has an average value of about 7,000 (PEG-7M is also known as Polyox WSR® N-750 from Union Carbide); PEG-9M wherein n has an average value of about 9,000 (PEG-9M is also known as Polyox WSR® N-3333 from Union Carbide); and PEG-14M wherein n has an average value of about 14,000 (PEG-14M is also known as Polyox WSR® N-3000 from Union Carbide).

COMPOSITIONS

In one preferred embodiment of the present invention, the composition comprises:

(a) from about 0.1% to about 20%, preferably from about 0.5% to about 5% of a cationic silicone emulsion;

(b) from about 0.1% to about 10%, preferably from about 1% to about 7% of a high melting point fatty compound;

(c) from about 0.1% to about 10%, preferably from about 0.25% to about 8%, more preferably from about 0.5% to about 3% of a cationic conditioning agent;

(d) an aqueous carrier.

This composition can provide increase in bulk hair volume, softness, moisturized feel, and fly-away control. It can also provide satisfactory spreadability on the hair, and can be made by a convenient manufacturing method.

In another preferred embodiment of the present invention, the composition comprises:

(a) from about 0.1% to about 20%, preferably from about 0.5% to about 5% of a cationic silicone emulsion;

(b) from about 0.1% to about 10% of a high melting point fatty compound;

(c) from about 0.55% to about 7%, preferably from about 1.2% to about 4.5% of a cationic conditioning agent, the cationic conditioning agent comprising an amidoamine and an acid; and

(d) the aqueous carrier.

This composition may further contain a low melting point oil selected from the group consisting of pentaerythritol ester oils, trimethylol ester oils, poly α-olefin oils, citrate ester oils, glyceryl ester oils, and mixtures thereof, which is preferably included in the composition at a level by weight of from about 0.1% to about 10%, more preferably from about 0.25% to about 6%.

This composition can provide provide the same benefits as those of the first embodiment, and further can provide the benefits such as slippery and slick feel on wet hair.

In another preferred embodiment of the present invention, the composition comprises:

A hair conditioning composition comprising:

(a) from about 0.1% to about 20%, preferably from about 0.5% to about 5% of a cationic silicone emulsion;

(b) from about 0.1% to about 5%, preferably from about 0.25% to about 2% of a high melting point fatty compound;

(c) from about 0.1% to about 10%, preferably from about 0.25% to about 5% of a cationic conditioning agent;

(d) an aqueous carrier;

(e) from about 0.1% to about 10%, preferably from about 0.25% to about 6% of a low melting point oil, the low melting point oil being an unsaturated fatty alcohol; and

(f) from about 0.1% to about 10%, preferably from about 0.25% to about 6% of a polyethylene glycol.

This composition can provides the same benefits as those of the first embodiment, and further can provide the benefits such as increase in bulk hair volume, softness, moisturized feel, and fly-away control on dry hair.

ADDITIONAL COMPONENTS

The composition of the present invention may include other additional components, which may be selected by the artisan according to the desired characteristics of the final product and which are suitable for rendering the composition more cosmetically or aesthetically acceptable or to provide them with additional usage benefits. Such other additional components generally are used individually at levels of from about 0.001% to about 10%, preferably up to about 5% by weight of the composition.

A wide variety of other additional components can be formulated into the present compositions. These include: other conditioning agents such as hydrolysed collagen with tradename Peptein 2000 available from Hormel, vitamin E with tradename Emix-d available from Eisai, panthenol available from Roche, panthenyl ethyl ether available from Roche, a mixture of Polysorbate 60 and Cetearyl Alcohol with tradename Polawax NF available from Croda Chemicals, glycerylmonostearate available from Stepan Chemicals, hydroxyethyl cellulose

available from Aqualon, hydrolysed keratin, proteins, plant extracts, and nutrients; hair-fixative polymers such as amphoteric fixative polymers, cationic fixative polymers, anionic fixative polymers, nonionic fixative polymers, and silicone grafted copolymers; preservatives such as benzyl alcohol, methyl paraben, propyl paraben and imidazolidinyl urea; pH adjusting agents, such as citric acid, sodium citrate, succinic acid, phosphoric acid, sodium hydroxide, sodium carbonate; salts, in general, such as potassium acetate and sodium chloride; coloring agents, such as any of the FD&C or D&C dyes; hair oxidizing (bleaching) agents, such as hydrogen peroxide, perborate and persulfate salts; hair reducing agents such as the thioglycolates; perfumes; and sequestering agents, such as disodium ethylenediamine tetra-acetate; ultraviolet and infrared screening and absorbing agents such as octyl salicylate, antidandruff agents such as zinc pyridinethione; and optical brighteners, for example polystyrylstilbenes, triazinstilbenes, hydroxycoumarins, aminocoumarins, triazoles, pyrazolines, oxazoles, pyrenes, porphyrins, imidazoles, and mixtures thereof.

EXAMPLES

The following examples further describe and demonstrate embodiments within the scope of the present invention. The examples are given solely for the purpose of illustration and are not to be construed as limitations of the present invention, as many variations thereof are possible without departing from the spirit and scope of the invention. Ingredients are identified by chemical or CTFA name, or otherwise defined below.

The compositions of the present invention are suitable for rinse-off products and leave-on products, and are particularly useful for making products in the form of emulsion, cream, gel, spray or, mousse.

Examples 1 through 8 are hair conditioning compositions of the present invention which are particularly useful for rinse-off use.

Compositions

Components	Ex. 1	Ex. 2	Ex. 3	Ex. 4
Cationic Silicone Emulsion-1*1	1.05		1.05	1.05
Cationic Silicone Emulsion-2*2		0.63		
Cetyl Alcohol *3	4.5	1.5	5.5	4.5
Stearyl Alcohol *4	2.5	2.7	2.5	1.5
Behenyl Alcohol *5				1.0
Stearamidopropyl Dimethylamine *6	2.0	1.2	2.3	2.0

ℓ-Glutamic Acid *7	0.64	0.384	0.73	0.64
Pentaerythritol Tetraisostearate *8	1.0		1.0	1.0
Preservatives	0.033	0.033	0.033	0.033
Benzyl alcohol	0.4	0.4	0.4	0.4
Perfume	0.6	0.6	0.6	0.6
Hydrolyzed collagen *9	0.01	0.01	0.01	0.01
Vitamin E *10	0.01	0.01	0.01	0.01
Panthenol *11	0.05	0.05	0.05	0.05
Panthenyl Ethyl Ether *12	0.05	0.05	0.05	0.05
Citric Acid *13	amount necessary to adjust pH 3 7			
Deionized Water	q.s. to 100%			

Components	Ex. 5	Ex. 6	Ex. 7	Ex. 8
Cationic Silicone Emulsion-1*1	1.05		0.8	
Cationic Silicone Emulsion-2*2		1.05		3.0
Cetyl Alcohol *3	0.96	0.96	1.2	0.7
Stearyl Alcohol *4	0.64	0.64	0.8	0.5
Behenyl Alcohol *5		0.2		
Stearamidopropyl Dimethylamine *6	1.0	1.2		0.75
Ditallow dimethyl ammonium chloride *14	0.75	0.82	0.46	0.5
Pentaerythritol Tetraisostearate *8		0.2	0.5	0.5
Pentaerythritol Tetraoleate *15				0.5
Oleyl alcohol *16	0.25	0.25		0.25
Trimethylolpropane Triisostearate *17		0.25		
PEG 2M *18	0.5	0.5	0.25	0.5
Polysorbate 60 *19	0.25	0.25	0.125	0.125
Cetearyl Alcohol *19	0.25	0.25	0.125	0.125
Glycerylmonostearate *20	0.25	0.25	0.25	0.25
Hydroxyethyl Cellulose *21	0.25			0.25
Preservatives	0.04	0.04	0.04	0.04
Benzyl alcohol	0.4	0.4	0.4	0.4
Perfume	0.6	0.6	0.6	0.6
Acid EDTA	0.1	0.01	0.02	0.01
Hydrolyzed collagen *9	0.01	0.01	0.01	0.01
Vitamin E *10	0.01	0.025	0.01	0.01
Panthenol *11	0.05	0.2	0.1	0.05
Panthenyl Ethyl Ether *12	0.05	0.05	0.01	0.05

Citric Acid *13	amount necessary to adjust pH 3 7
Deionized Water	q.s. to 100%

Definitions of Components

*1 Cationic Silicone Emulsion-1: PE2006 obtained from Dow Corning; mechanically emulsified emulsion containing 60% silicone compound and 3.0% cationic surfactant, wherein the silicone compound has a particle size of about 280 nm, and is made by using polydimethylsiloxane having about 900 repeating units and polydimethylsiloxane having about 100 repeating units, in a ratio of 27:73.

*2 Cationic Silicone Emulsion-2: PE2016 obtained from Dow Corning; is mechanically emulsified emulsion containing 55% silicone compound and 3.0% cationic surfactant, wherein the silicone compound has a particle size of about 280 nm, and is made by using polydimethylsiloxane having about 900 repeating units and polydimethylsiloxane having about 100 repeating units, in a ratio of 27:73.

*3 Cetyl Alcohol: Konol series obtained by Shin Nihon Rika.

*4 Stearyl Alcohol: Konol series obtained by Shin Nihon Rika.

*5 Behenyl Alcohol: 1-Docosanol (97%) obtained by Wako.

*6 Stearamidopropyl Dimethylamine: Amidoamine MPS obtained by Nikko.

*7 ℓ-Glutamic Acid: ℓ-Glutamic acid (cosmetic grade) obtained by Ajinomoto.

*8 Pentaerythritol Tetraisostearate: KAK PTI obtained by Kokyu alcohol.

*9 Hydrolyzed collagen: Peptein 2000 obtained by Hormel.

*10 Vitamin E: Emix-d obtained by Eisai.

*11 Panthenol: Available from Roche.

*12 Panthenyl Ethyl Ether: Available from Roche.

*13 Citric Acid: Anhydrous Citric acid obtained by Haarman & Reimer.

*14 Ditallow dimethyl ammonium chloride: Available from Witco Chemicals.

*15 Pentaerythritol Tetraoleate: Available from Shin NihonRika.

*16 Oleyl alcohol: Available from New Japan Chemical.

*17 Trimethylolpropane Triisostearate: KAK TTI obtained by Kokyu alcohol.

*18 PEG-2M: Polyox obtained by Union Carbide.

*19 Polysorbate 60, Cetearyl Alcohol: mixture sold as Polawax NF obtained by Croda Chemicals.

*20 Glycerylmonostearate: Available from Stepan Chemicals.

*21 Hydroxyethyl Cellulose: Available from Aqualon.

Method of Preparation

The compositions of Examples 1 through 8 as shown above can be prepared by any conventional method well known in the art. They are suitably made as follows: If included in the composition, polymeric materials such as hydroxyethyl cellulose and polyethylene glycol are dispersed in water at room temperature to make a polymer solution, and heated up to above 70°C. Amidoamine and acid, or other cationic conditioning agents, and if present, ester oil of low melting point oil are added in the solution with agitation. Then high melting point fatty compound, and if present, other low melting point oils and benzyl alcohol are also added in the solution with agitation. The mixture thus obtained is cooled down to below 60°C, and the remaining components such as cationic silicone emulsion are added with agitation, and further cooled down to about 30°C.

A triblender and/or mill can be used in each step, if necessary to disperse the materials.

The embodiments disclosed and represented by the previous examples have many advantages. For example, they can provide increase in bulk hair volume, softness, moisturized feel, and fly-away control. They can also provide satisfactory spreadability on the hair, and can be made by a convenient manufacturing method.

It is understood that the examples and embodiments described herein are for illustrative purposes only and that various modifications or changes in light thereof will be suggested to one skilled in the art without departing from its spirit and scope.